

IN THE CLAIMS

Claims 1-28 (canceled)

29. (new) A process for coating a metallic surface, with an aqueous composition, also comprising, if desired, organic solvent and other components, which is substantially or entirely free from chromium (VI) compounds, for the purpose of pretreatment prior to a further coating or for treatment, wherein said aqueous composition comprises water and,

- a) at least one hydrolyzable and/or at least partly hydrolyzed fluorine-free silane and
- b) at least one hydrolyzable and/or at least partly hydrolyzed fluorine-containing silane, and
- c) at least one metal chelate or/and
- d) at least one oligomer/polymer/copolymer,

the ratio of the monomers/oligomers/polymers/copolymers of component d) to silanes a) and b) in the concentrate and/or in the bath being in the range from 0.1:1 to 10:1,

the silanes in the composition being water-soluble or becoming water-soluble by virtue of (further) hydrolysis reactions and/or chemical reactions prior to application to the metallic surface,

comprising contacting the clean, pickled, cleaned and/or pretreated metallic surface with the aqueous composition to form a film on the metallic surface and subsequently drying and, optionally curing the film,

wherein the dried and optionally cured film has a thickness in the range from 0.001 to 10 μm .

30. (new) The process according to claim 29, wherein in the aqueous composition selected from the fluorine-free silanes there is in each case at least one acyloxysilane, alkoxysilane, silane having at least one amino group such as an aminoalkylsilane, silane having at least one succinic group and/or succinic anhydride group, bis-silyl-silane, silane having at least one epoxy group such as a glycidyloxysilane, (meth)acrylatosilane, multi-silyl-silane, ureidosilane, vinylsilane and/or at least one silanol and/or at least one siloxane or siloxane whose composition corresponds chemically to that of the aforementioned silanes.

31. (new) The process according to claim 29, wherein said at least one fluorine-free silane is selected from the group consisting of, or based on,

glycidyloxyalkyltrialkoxysilane,
methacryloyloxyalkyltrialkoxysilane,
(trialkoxysilyl)alkylsuccinoylsilane,
aminoalkylaminoalkylalkyldialkoxysilane,
(epoxycycloalkyl)alkyltrialkoxysilane,
bis(trialkoxysilylalkyl)amine,
bis(trialkoxysilyl)ethane,
(epoxyalkyl)trialkoxysilane,
aminoalkyltrialkoxysilane,
ureidoalkyltrialkoxysilane,
N-(trialkoxysilylalkyl)alkylenediamine,
N-(aminoalkyl)aminoalkyltrialkoxysilane,
N-(trialkoxysilylalkyl)dialkylenetriamine,
poly(aminoalkyl)alkyldialkoxysilane,
tris(trialkoxysilyl)alkyl isocyanurate,
ureidoalkyltrialkoxysilane and
acetoxysilane.

32. (new) The process according to claim 29, wherein said at least one silane is selected from the group consisting of, or is based on,

3-glycidyloxypropyltriethoxysilane,
3-glycidyloxypropyltrimethoxysilane,
3-methacryloyloxypropyltriethoxysilane,
3-methacryloyloxypropyltrimethoxysilane,
3-(triethoxysilyl)propylsuccinoylsilane,
aminoethylaminopropylmethyldiethoxysilane,
aminoethylaminopropylmethyldimethoxysilane,
beta-(3,4-epoxycyclohexyl)ethyltriethoxysilane,
beta-(3,4-epoxycyclohexyl)ethyltrimethoxysilane,
beta-(3,4-epoxycyclohexyl)methyltriethoxysilane,
beta-(3,4-epoxycyclohexyl)methyltrimethoxysilane,
gamma-(3,4-epoxycyclohexyl)propyltriethoxysilane,
gamma-(3,4-epoxycyclohexyl)propyltrimethoxysilane,
bis(triethoxysilylpropyl)amine,
bis(trimethoxysilylpropyl)amine,
(3,4-epoxybutyl)triethoxysilane,
(3,4-epoxybutyl)trimethoxysilane,
gamma-aminopropyltriethoxysilane,
gamma-aminopropyltrimethoxysilane,
gamma-ureidopropyltrialkoxysilane,
N-(3-(trimethoxysilyl)propyl)ethylenediamine,
N-beta-(aminoethyl)-gamma-aminopropyltriethoxysilane,
N-beta-(aminoethyl)-gamma-aminopropyltrimethoxysilane,
N-(gamma-trimethoxysilylpropyl)diethylenetriamine,
N-(gamma-trimethoxysilylpropyl)diethylenetriamine,
N-(gamma-trimethoxysilylpropyl)dimethylenetriamine,
N-(gamma-trimethoxysilylpropyl)dimethylenetriamine,
poly(aminoalkyl)ethyldialkoxysilane,
poly(aminoalkyl)methyldialkoxysilane,
tris(3-(triethoxysilyl)propyl) isocyanurate,
tris(3-(trimethoxysilyl)propyl) isocyanurate and vinyltriacetoxy silane.

33. (new) The process according to claim 29, wherein in the aqueous composition selected from the fluorine-containing silanes there is in each case at least one acyloxysilane, alkoxysilane, alkoxysilane, silane having at least one amino group such as an aminoalkylsilane, silane having at least one succinic acid group and/or succinic anhydride group, bis-silyl-silane, silane having at least one epoxy group such as a glycidyloxy silane, (meth)acrylato-silane, multi-

silyl-silane, ureidosilane, vinylsilane and/or at least one silanol and/or at least one siloxane or polysiloxane whose composition corresponds chemically to that of the aforementioned silanes, containing in each case at least one group that contains at least one fluorine atom.

34. (new) The process according to claim 29, wherein the aqueous composition comprises at least one fluoroalkoxyalkylsilane, at least one mono-, di- or trifunctional fluorosilane, at least one mono-, bis- or tris-fluorosilane, at least one fluorosilane based on ethoxysilane and/or based on methoxysilane and/or at least one fluorosilane having at least one functional group such as, for example, an amino group, in particular in the form of a cocondensate, such as fluoroalkyldialkoxysilane, a fluoroaminoalkylpropyltrialkoxysilane, a fluoromethanesulfonate, a fluoropropylalkyldialkoxysilane, a triphenylfluorosilane, a trialkoxyfluorosilane, a trialkylfluorosilane and/or a tridecafluoroctyltrialkoxysilane.

35. (new) The process according to claim 29, wherein the silane contains at least two amino groups and also at least one ethyl group and/or at least one methyl group.

36. (new) The process according to claim 29, wherein the aqueous composition further comprises at least one component e) selected from the group consisting of:

- e₁) at least one inorganic compound in particle form, having an average particle diameter, measured on a scanning electron microscope, in the range from 0.005 to 0.3 µm in diameter,
- e₂) at least one lubricant,
- e₃) at least one organic corrosion inhibitor,
- e₄) at least one anti-corrosion pigment,
- e₅) at least one agent for neutralizing and/or sterically stabilizing the synthetic resins,

- e₆) at least one organic solvent,
- e₇) at least one siloxane,
- e₈) at least one long-chain alcohol, and
- e₉) at least one surfactant.

37. (new) The process according to claim 29, wherein the organic film former is a synthetic resin mixture of at least one polymer and/or at least one copolymer, comprising synthetic resin based on acrylate, epoxide, ethylene, urea-formaldehyde, phenol, polyester, polyurethane, styrene, styrene-butadiene and/or vinyl.

38. (new) The process according to claim 29, wherein the organic film former also comprises as synthetic resin an amount of organic polymer, copolymer and/or mixtures thereof based on polyethyleneimine, polyvinyl alcohol, polyvinylphenol, polyvinylpyrrolidone and/or polyaspartic acid, in particular copolymers with a phosphorus-containing vinyl compound.

39. (new) The process according to claim 29, wherein the acid groups of the synthetic resins are stabilized with ammonia, with amines such as morpholine, dimethylethanolamine, diethylethanolamine or triethanolamine and/or with alkali metal compounds such as sodium hydroxide.

40. (new) The process according to claim 29, wherein the aqueous composition contains from 0.1 to 980 g/l of the organic film former.

41. (new) The process according to claim 29, wherein the amount of at least one fluorine-free silane in the aqueous composition, including the reaction products formed therefrom, is from 0.05 to 300 g/l.

42. (new) The process according to claim 29, wherein the amount of at least one fluorine-containing silane in the aqueous composition, including the reaction products formed therefrom is from 0.01 to 150 g/l.

43. (new) The process according to claim 29, wherein the at least one metal chelate is selected from the group consisting of chelate complexes based on acetylacetones, acetoacetic esters, acetonates, alkylenediamines, amines, lactates, carboxylic acids, citrates and/or glycols, the amount of at least one chelate in the aqueous composition, including any reaction products formed therefrom, being preferably from 0.1 to 80 g/l.

44. (new) The process according to claim 29, wherein the inorganic compound is in particle form as a finely divided powder, a dispersion or a suspension such as a carbonate, oxide, silicate or sulfate is added, optionally as colloidal and/or amorphous particles.

45. (new) The process according to claim 29, wherein as inorganic compound in particle form particles are added based on at least one compound of aluminum, of barium, of cerium, of calcium, of lanthanum, of silicon, of titanium, of yttrium, of zinc and/or of zirconium.

46. (new) The process according to claim 29, wherein as lubricant at least one wax is used selected from the group consisting of paraffins, polyethylenes and polypropylenes, in particular an oxidized wax, the amount of waxes in the aqueous composition being preferably in the range from 0.01 to 5% by weight.

47. (new) The process according to claim 29, wherein the coating is partly produced by drying and filming and/or is cured by actinic radiation, cationic polymerization and/or thermal crosslinking.

48. (new) The process according to claim 29, wherein the aqueous composition comprises at least one additive, in particular at least one selected from the group consisting of at least one biocide, at least one defoamer and/or at least one wetting agent.

49. (new) The process according to claim 29, wherein the coated metallic surface is dried at a temperature in the range from 20 to 400°C forced-air temperature.

50. (new) The process according to claim 29, wherein the aqueous composition is applied by rolling, flow coating, knife coating, spraying, squirting, brushing or dipping and if desired by subsequent squeezing off with a roller.

51. (new) The process according to claim 29, wherein in each case at least one coating of printing ink, film, paint, paint-like material, powder coating material, adhesive and/or adhesive backing is applied to the dry and also, where appropriate, cured film.

52. (new) The process according to claim 29, wherein the coated metal parts, strips or strip sections are formed, painted, coated with polymers such as PVC, for example, printed, bonded, hot-soldered, welded and/or joined with one another or with other elements by clinching or other joining techniques.

53. (new) An aqueous composition for pretreating a metallic surface prior to a further coating or for treating the said surface comprising water and

- a) at least one hydrolyzable and/or at least partly hydrolyzed fluorine-free silane and
- b) at least one hydrolyzable and/or at least partly hydrolyzed fluorine-containing silane, and
- c) at least one metal chelate or/and
- d) at least one oligomer/polymer/copolymer,

wherein the ratio of the monomers /oligomers/polymers /copolymers of component d) to silanes (a) and b) in the concentrate and/or in the bath is in the range from 0.1:1 to 10:1,

wherein the proportion of a) to b) in each case including the reaction products formed therefrom being preferably in the range from 1:0.01 to 1:4 and the silanes in the composition being water-soluble or in particular water-soluble owing to (further) hydrolysis reactions and/or chemical reactions.

54. (new) A substrate coated by the process as claimed in claim 29, wherein said substrate is selected from the group consisting of a wire, strip, sheet or part for a wire winding, a wire mesh, a steel strip, a metal sheet, a panel, a shield, a vehicle body or part of a vehicle body, a part of a vehicle, trailer, mobile home or missile, a cover, a casing, a lamp, a light, a traffic light element, a furniture item or furniture element, an element of a household appliance, a frame, a profile, a molding of complex geometry, a guideboard element, radiator element or fencing element, a fender, a part of or with at least one pipe and/or profile, a window frame, door frame or cycle frame or a small part such as a bolt, nut, flange, spring or a spectacle frame.

55. (new) The method of claim 29, wherein the composition is applied as an after rinse solution which is applied to a preceding coating.

56. (new) The method of claim 55, wherein the preceding coating is a conversion coating, and/or applied for blank corrosion protection.